E-951 TARGET HARDWARE

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E-951 Collaboration for Targetry Design
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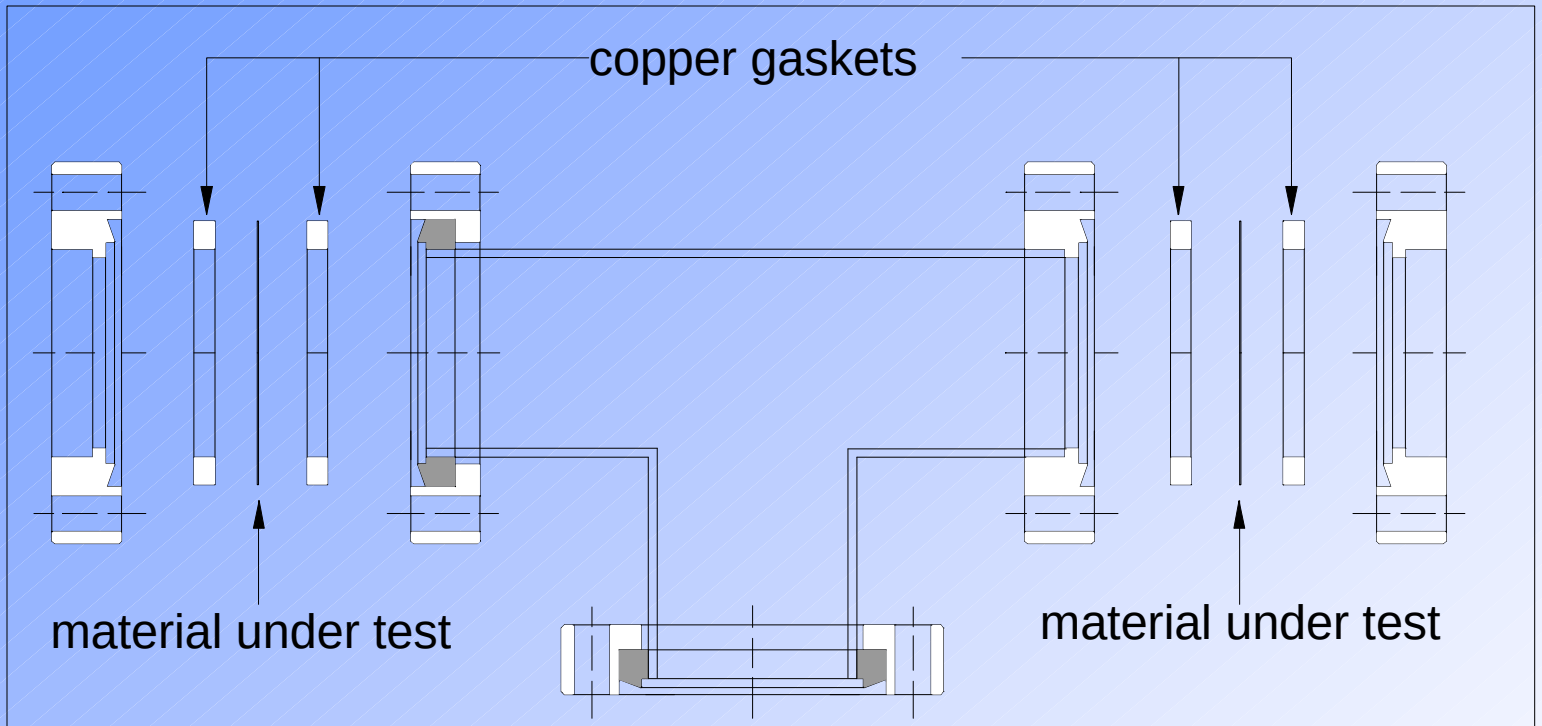
Beam Window Material Evaluations

- Prior to use of mercury targets, beam window materials need to be evaluated.
- A simple fixture is needed to allow candidate window materials to be exposed to beam.
- The proposed approach:
  - Assemble materials on a Conflat type 2.73” tee, rough pump down, valve off, and measure a leak rate.
  - Let up to air, and expose to prescribed number of beam pulses.
  - Rough down again, valve off, and compare the leak rate to previous measurement.

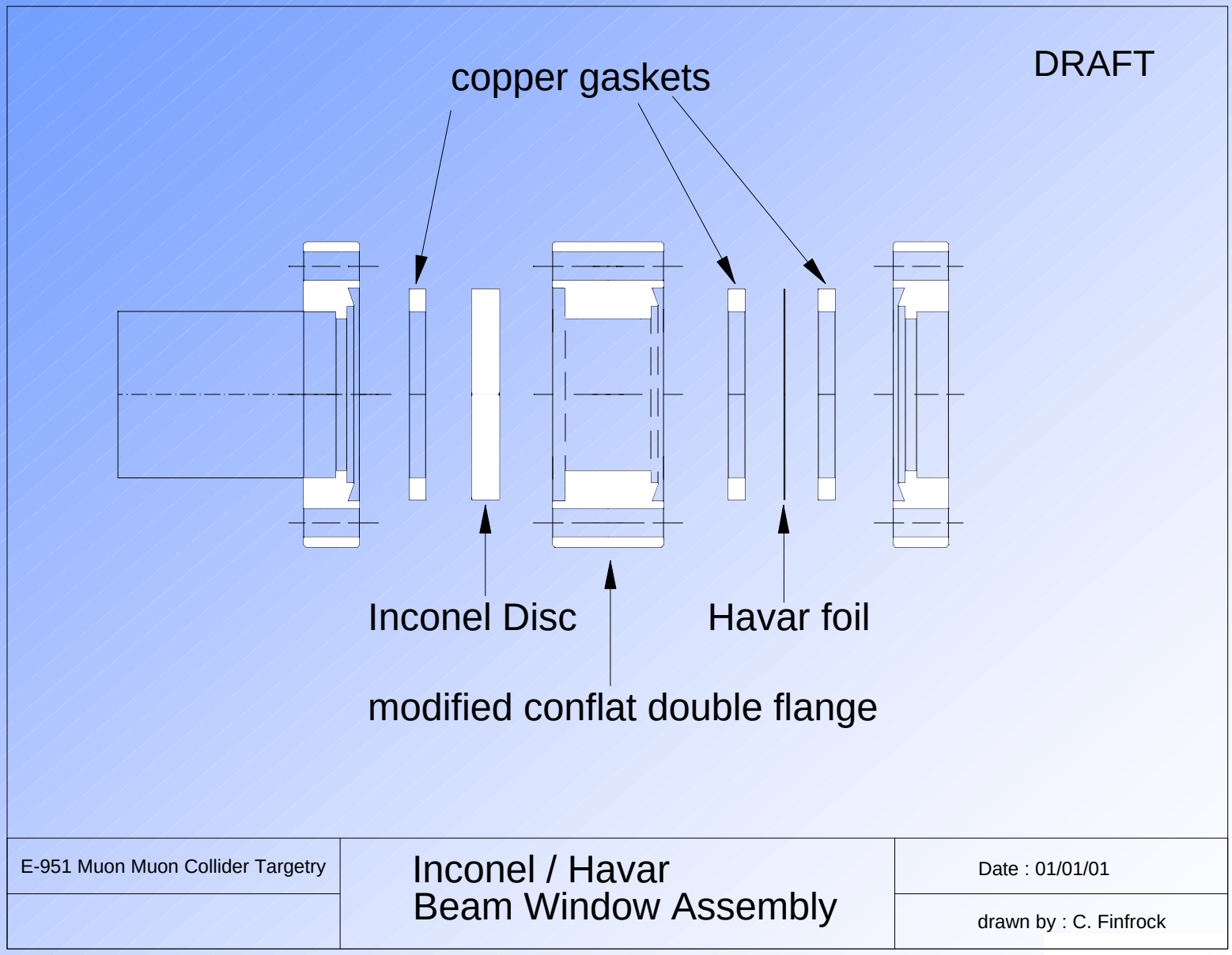
Beam Window Material Test Fixture



Flange for bolting to vacuum test stand, post irradiation.

E-951 Muon Muon Collider Targetry	Beam Window Test Fixture	Date : 1/4/01
DRAFT		drawn by : C. Finfrock

Inconel / Havar Beam Window Assembly



E-951 Muon Muon Collider Targetry	Inconel / Havar Beam Window Assembly	Date : 01/01/01
		drawn by : C. Finfrock

Mercury Target Requirements

- Generate a one cm. diameter arcing horizontal jet of mercury to provide a 10 to 15 cm interaction length with the proton beam.
- Provide an unobstructed view of the interaction zone for high speed imaging.
- Operate simply, reliably and remotely.
- Safely contain projectiles which may be generated by mercury-beam interactions
- Manage mercury vapor generation
- Mounting system to provide for easy interchange of other test targets
- Materials of construction must be compatible with mercury and survive a radiation environment.

Main Features of Pneumatic Mercury Jet Apparatus (1)

- Mercury jet containments:
  - dual containment assembly for mercury containment
  - external fiducial registration for quick installation and replacement
  - constructed of commercially available components wherever possible
- Primary containment:
  - constructed out of commercial vacuum components
  - may be inerted, vented to atmosphere through mercury traps
  - pressure relief and liquid level sensors on mercury reservoirs
  - remote pneumatic operation, no active electrical components
  - interior is mercury wetted, all materials mercury compatible
  - can be isolated and pressurized for leak testing
  - beam windows are Inconel 718 and / or Havar

Main Features of Pneumatic Mercury Jet Apparatus (2)

- Secondary containment:
  - commercially fabricated out of welded stainless steel
  - air atmosphere, always vented to atmosphere through mercury traps
  - no active electrical components
  - interior is not mercury wetted, but all components are mercury compatible
  - interior can be manually sniffed for mercury
  - view ports are quartz or Lexan
  - approximate size: 20” wide x 20” high x 36” long

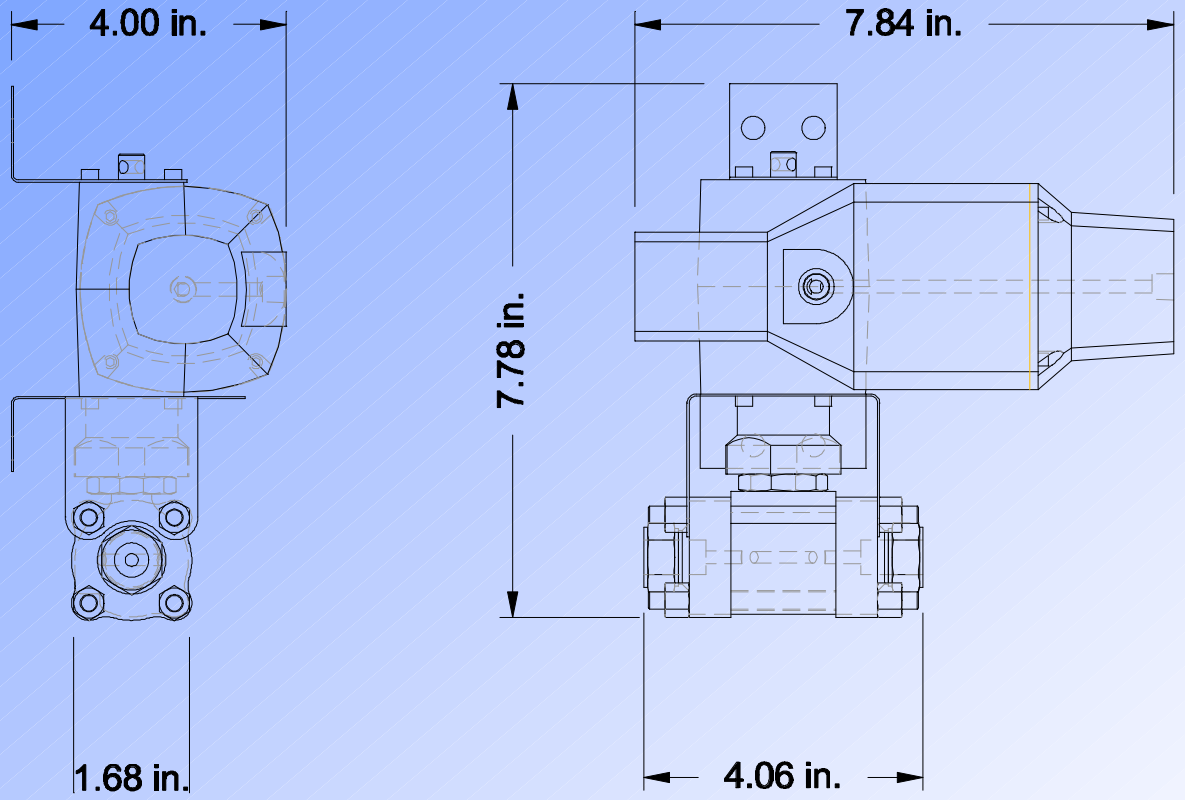
Main Features of Pneumatic Mercury Jet Apparatus (3)

- Mode of operation:
  - pneumatic operation and control to provide a 5-second duration mercury jet
  - two-dimensional positioning table is remotely controlled
  - remote operation of jet apparatus by computer control
  - minimize beam line entry requirements and radiation exposure
  - mercury sniffer on hand during operation
  - visual detection of mercury in secondary containment
  - all components are mercury compatible
  - radiation resistant materials such as poly-ether-ether-ketone valve seats, ethylene-propylene o-rings and Viton or copper flange gaskets are used
  - can reset for next test remotely in minutes

Materials Considerations

- Containments:
  - commercially available stainless steel components for inner containment
  - welded stainless steel sheet for outer containment
  - Inconel-718 / Havar alloy external beam windows
  - Quartz or Lexan internal view ports
  - Quartz or Lexan external view ports
- Valves:
  - stainless steel bodies
  - Poly-Ether-Ether-Ketone seats
  - Ethylene-Propylene or “grafoil” flange seals
  - non-fluorocarbon actuators
  - pressure ratings in excess of 1000 psig

Pneumatically Actuated Ball Valve for Liquid Mercury

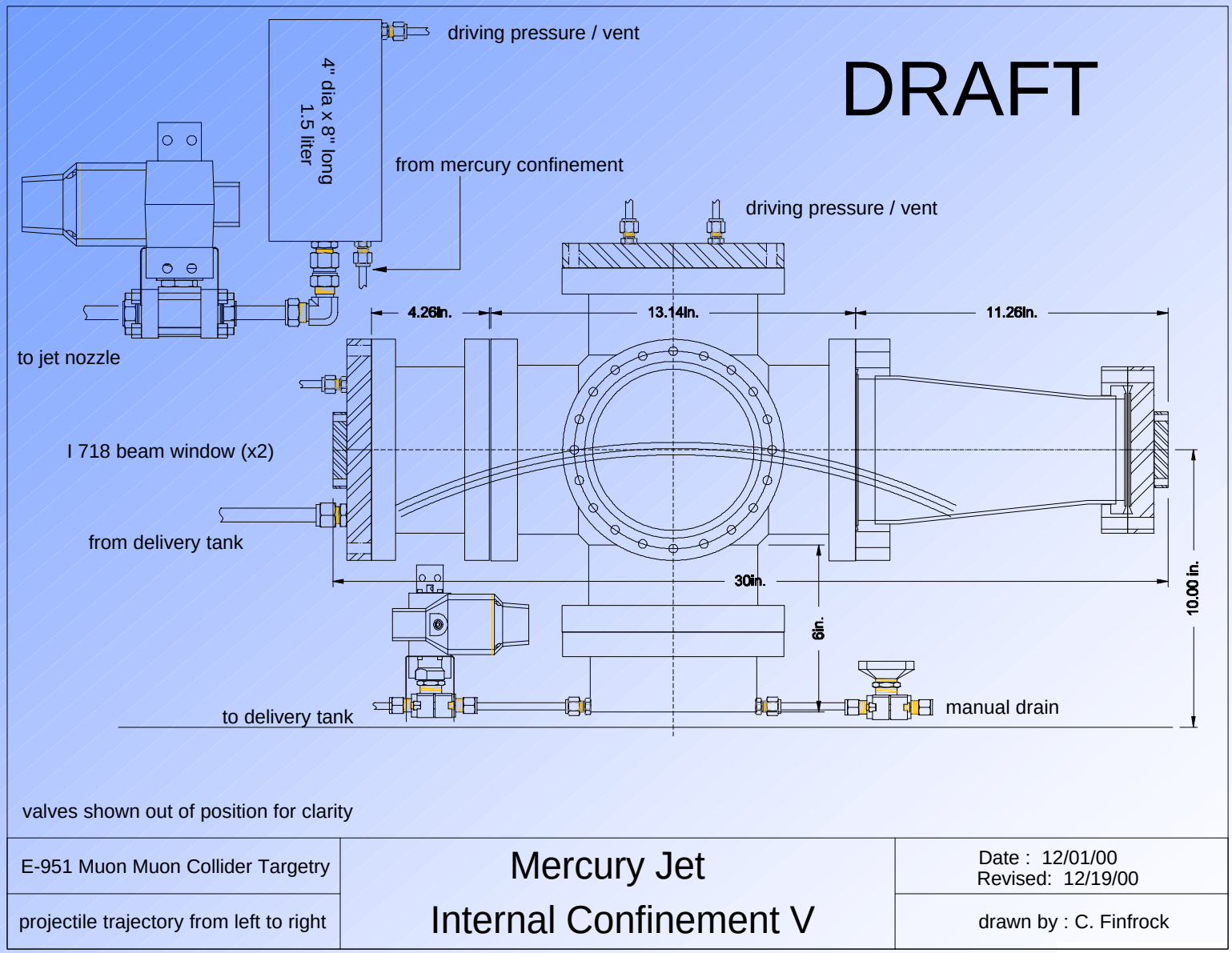


weight: 7.24 lbs
body: stainless steel
seats: teflon
cost: $391.10

1/2 inch swagelok fittings
rated 2200 psig from -20 to 100 F
rated 800 psig at 300 F
rated 100 psig at 450 F

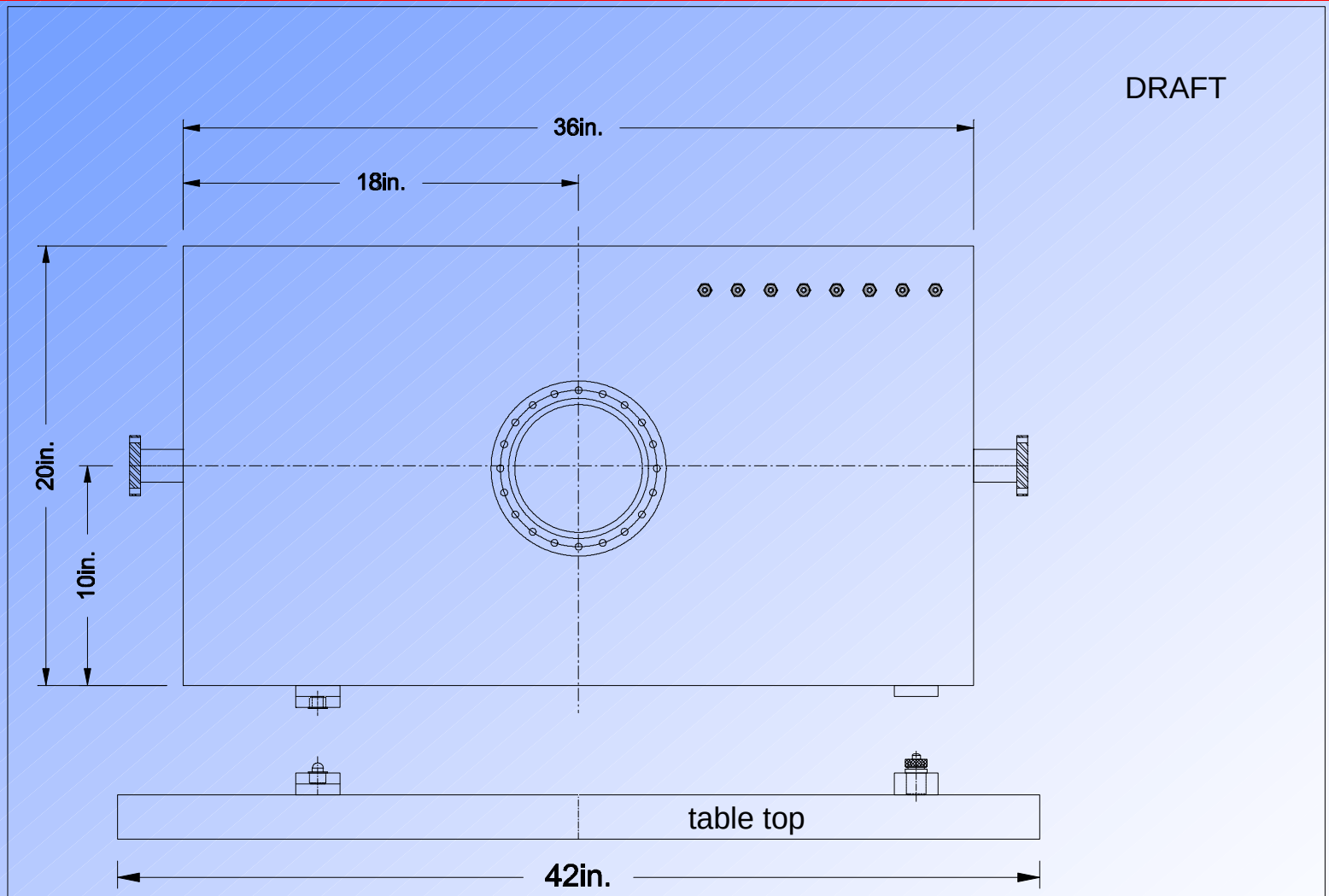
E-951 Muon Muon Collider Targetry	Whitey "60" series valve with pneumatic actuator	Date : 11/17/00
part numberSS-63TS8-33C		prepared by : C. Finfrock

Mercury Jet Internal Confinement, Integral Reservoir Design

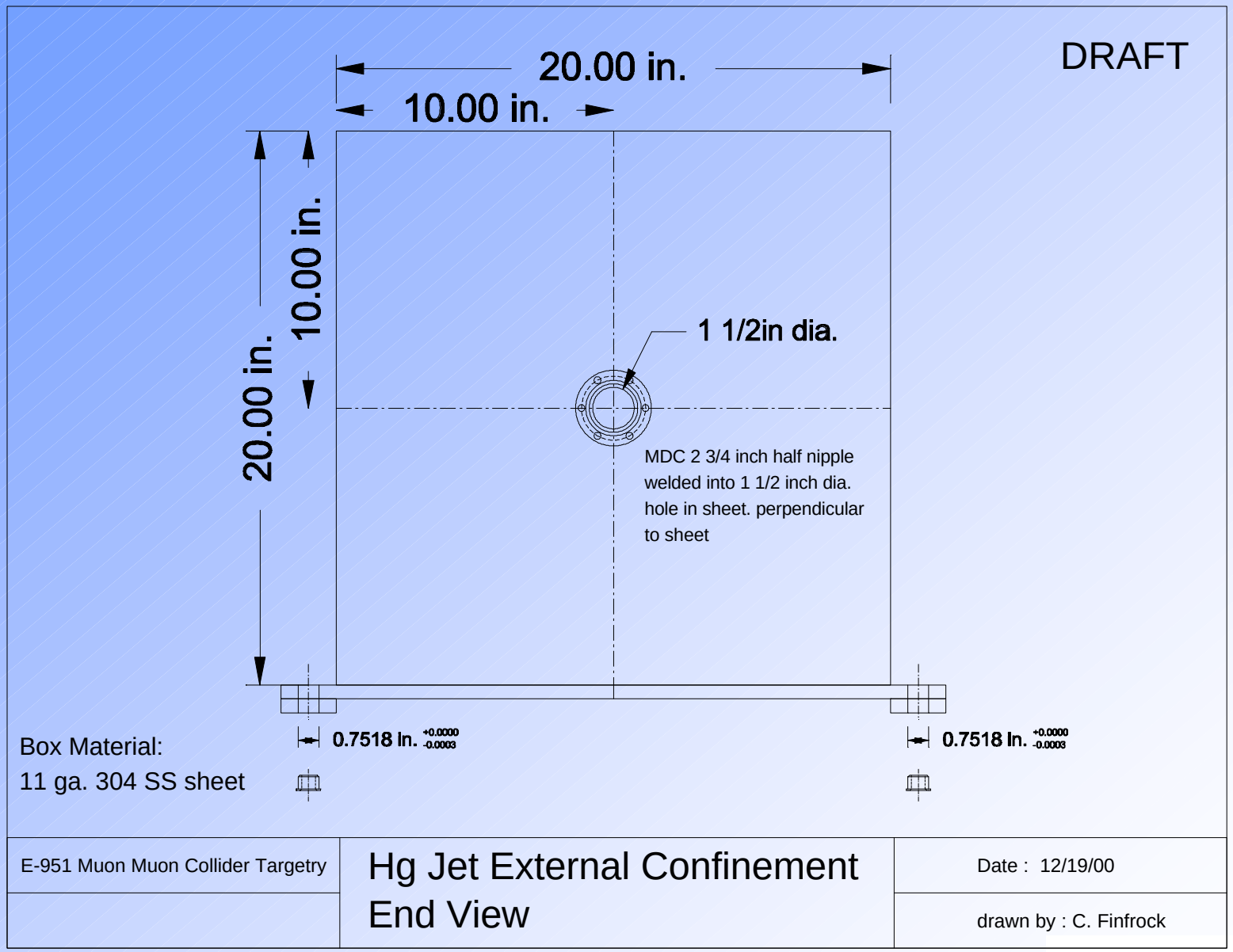


E-951 Muon Muon Collider Targetry	Mercury Jet Internal Confinement V	Date : 12/01/00 Revised: 12/19/00
projectile trajectory from left to right		drawn by : C. Finfrock

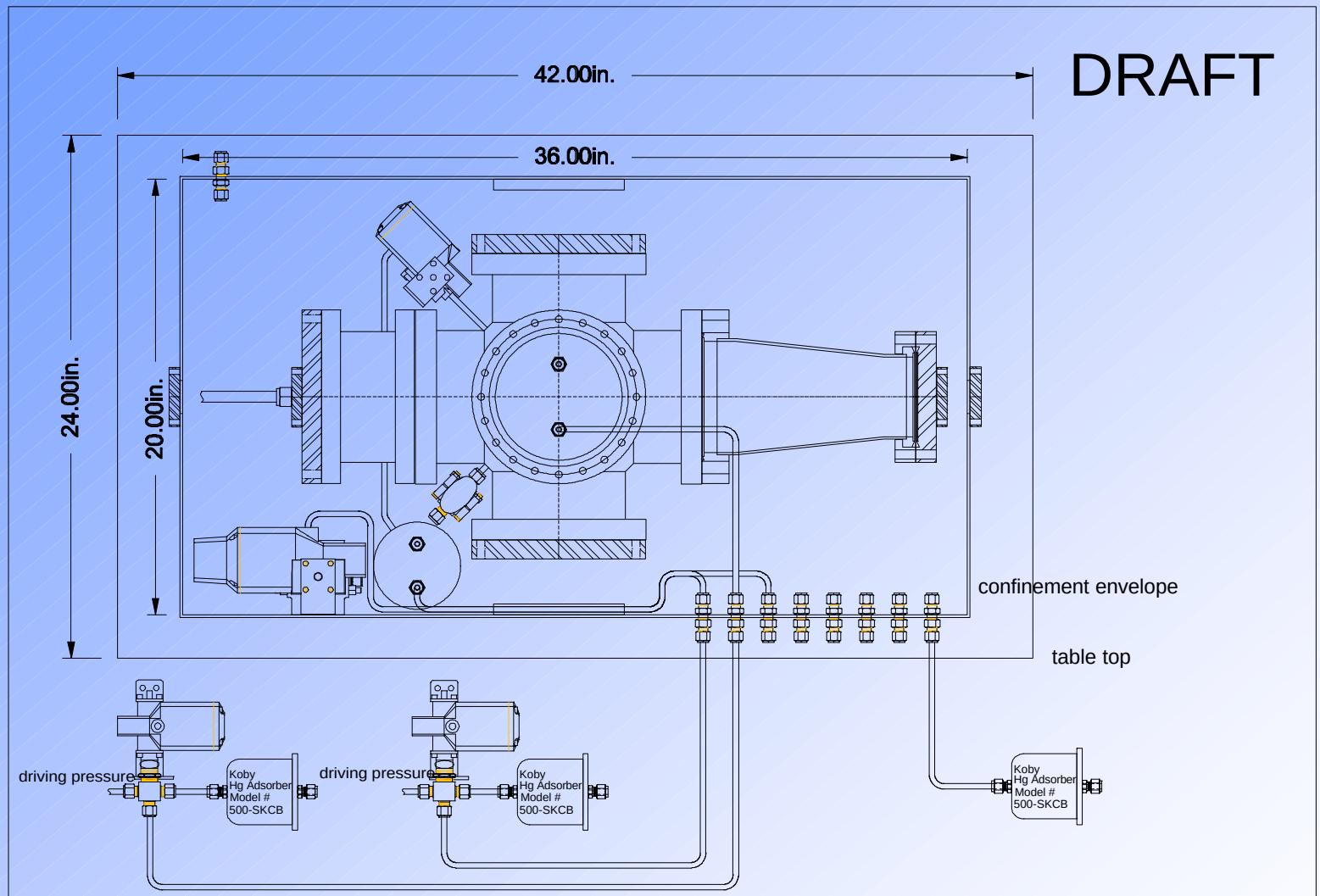
Side View of the Secondary Confinement



End View of the Secondary Confinement



Looking Into The Secondary Confinement From Above



E-951 Muon Muon Collider Targetry	Hg Jet Component Layout in External Confinement, Plan View	Date : 12/06/00 Revised : 12/14/00
particle trajectory from left to right		drawn by : C. Finfrock

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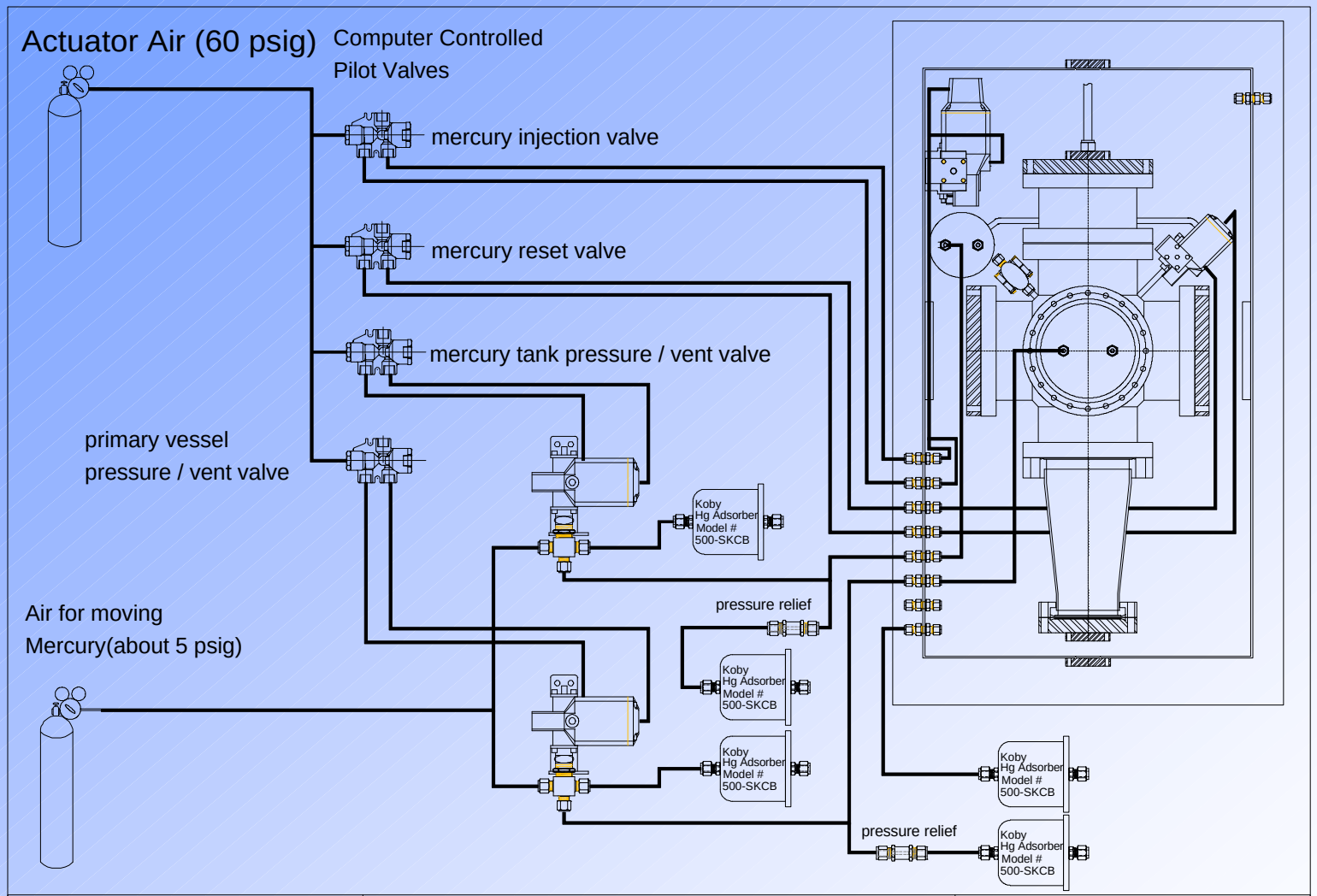
Pneumatic Control System for Mercury Jet



E-951 Muon Muon Collider Targetry	Schematic of Plumbing System	Date : 1/4/01
NOT TO SCALE	DRAFT	drawn by : C. Finfrock

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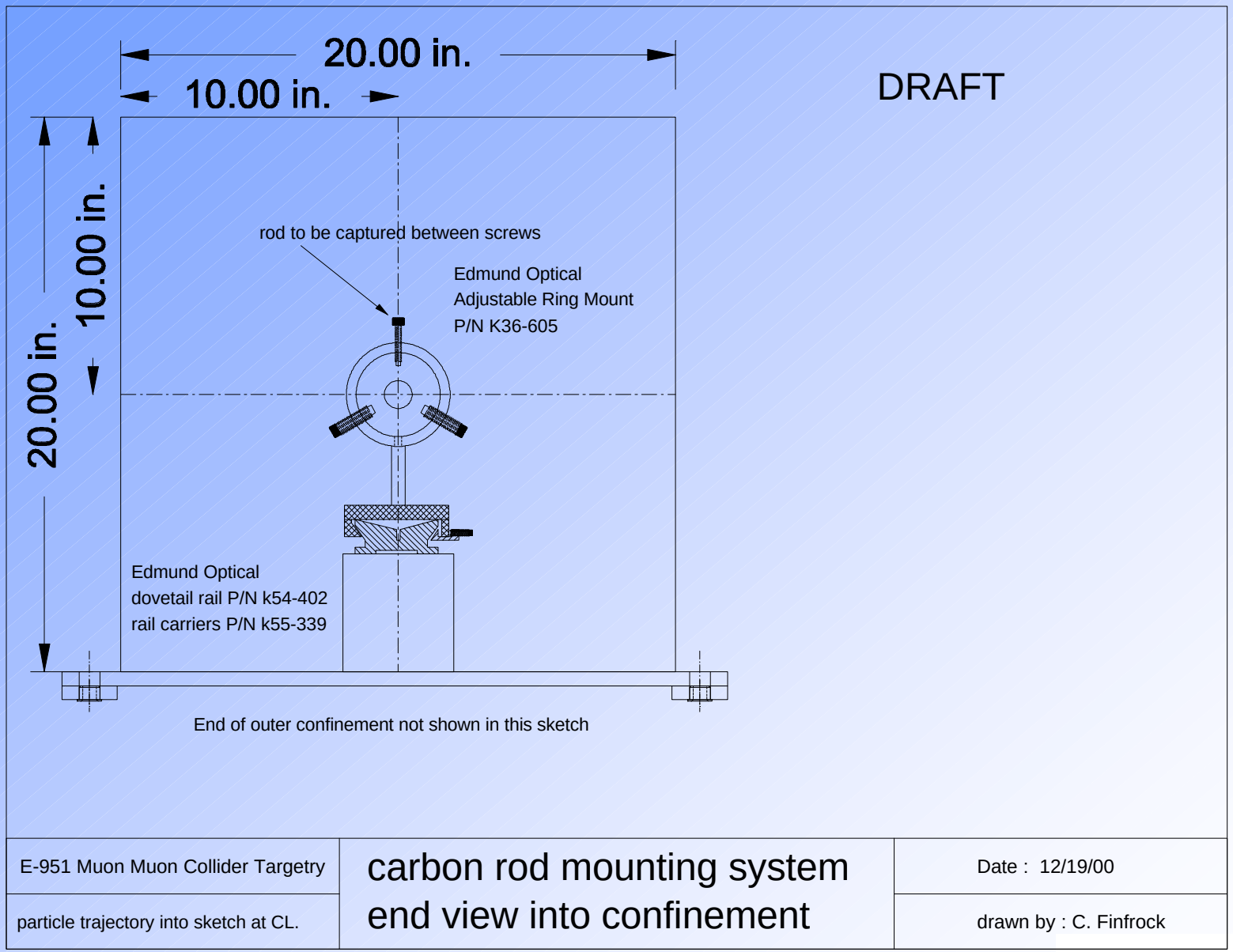
Other Targets

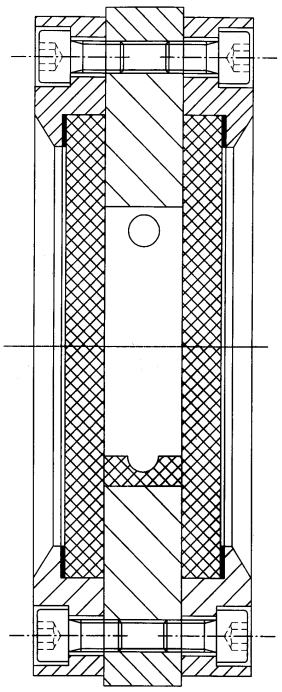
- Carbon / Graphite Rod targets (ORNL)
  - Cylindrical solid rods up to 2.54 cm. dia. by 60 cm. long
  - Instrumented with fiber-optic strain gauges
  - Enclosed in external confinement similar to mercury jet test
- Static Mercury Target (CERN)
  - Enclosed in external confinement similar to mercury jet test
  - operates passively

Mounting System for Solid Cylindrical Targets

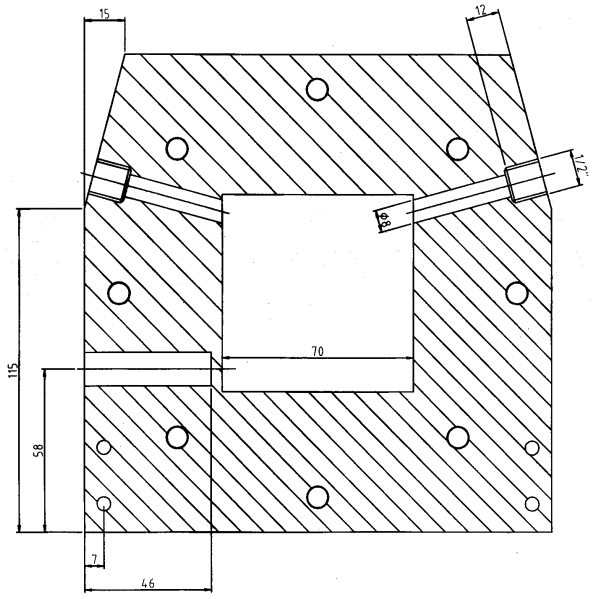


E-951 Muon Muon Collider Targetry	carbon rod mounting system end view into confinement	Date : 12/19/00
particle trajectory into sketch at CL.		drawn by : C. Finfrock

The CERN Passive Hg Trough



Beamline View



Cross-section view

Current Status

- Water jet tests are complete.
- Mercury jet target designs are substantially complete, minor detailing still underway.
- Test stand is installed in the beam line.
- Materials list with prices and quotes about 85% complete. Ready to order many components now.
- Next step is to complete the experiment safety review, and begin target construction.